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HUNGARY IRRIGATES 100,000 CADASTRAL YOKES IN 1951

By Jeno Alcser

Due to the devastations of the war, only 4,000 cadastral yokes were irrigated in Hungary in 1945. By 1950, irrigation was extended to 56,000 cadastral yokes, while this year, nearly 100,000 cadastral yokes are under irrigation.

Development of irrigation will be accelerated in the future, and by the end of the Five-Year Plan, the irrigated area will reach 370,000 cadastral yokes; this will require several million forints of investment. Organizational and technological improvement, however, has not kept pace with the large-scale extension of the irrigation projects. The problems may be expressed in the following two categories:

1. Organizational questions of the various irrigation projects.

2. Agricultural and technical problems of farms under irrigation.

In the past, when a large irrigation project was planned, only its capacity, expressed in cubic meters per second, and the extent and location of the area served were established, but the selection of the crops was left to the growers. This situation has been aggravated by the erroneous belief that rice is the most profitable crop on irrigated plots. This explains the sudden rise in rice production during the years of reconstruction. As a consequence, in the Tiszafured irrigation system, which has a capacity of 6 cubic meters per second, only approximately 6,000 - 7,000 cadastral yokes, mainly rice fields, are under irrigation.

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Contrary to the popular belief, irrigation of rice fields is the least profitable as compared to the profits of other artificially watered crops. It has been proved that 3.9 cadastral yokes of arable land, or 5.3 cadastral yokes of pasture, or 1.9 cadastral yokes of truck farm can be irrigated with the same volume of water that is used for the irrigation of one cadastral yoke of rice field. Of course, it would be unwise to discontinue the cultivation of rice; it is still important to extend it, especially on arid soil, if the climatic conditions are favorable. It is equally important, however, that in the interest of the entire production of the country the limited irrigation projects should not be utilized exclusively for the cultivation of rice; therefore, the ratio between the various crops to be irrigated and the volume of water to be used has to be determined.

In the past the majority of the irrigation projects was used mainly for rice fields. Regardless of the size of the project, the canals and the technical installations had a capacity of 2 liters per second per cadastral yoke, which was adequate for the growing period of the rice. However, after a few years, when rice was replaced by fodder or cultivated crops, the irrigation project could be utilized only at 15 to 20 percent of its capacity until after several years the cultivation of rice was resumed.

This loss may be avoided by cultivating rice according to the system of crop rotation and by building the irrigation stations to suit the water requirements of the various plants within the crop rotation. For the better utilization of the installation, it is necessary to inaugurate crop rotation and irrigation systems which will contribute materially to the economy of the projects. To realize this object, crop rotation used in connection with the irrigation and water requirements of the various plants must be planned in advance. The crop rotation of irrigation farming may be divided into three groups: rice, fodder, and truck-farming rotations.

There is still a tendency to use a large volume of water for irrigation, due partly to the defects of the technical equipment and partly to inadequate experience in irrigation. According to the records of the irrigation enterprises, the farmers use 50 to 60 percent more water than necessary. Since irrigation is, to a certain extent, detrimental to the composition of the soil and excessive irrigation endangers the plants, it is important to use the proper volume of water. Waste of water also necessitates the construction of more extensive canals and technical equipment, which results in higher expenditure.

As to the water requirements of rotated crops, precipitation and soil moisture have to be taken into consideration, even if the regions with the poorest precipitation have an annual average rainfall of 500-550 millimeters, of which 278 millimeters fall during the growing seasons. The above volume is only slightly less than the minimum which, according to Kruger, amounts to 280 millimeters and, according to Zunker, to 290 millimeters. Since the deviation from the average acts both ways, there is a deficienc in precipitation every other year. This deficiency may be eliminated with the help of one or two irrigations, although these may hinder a higher crop average on better soil, while they may lead to entirely unfavorable results on poor soil.

For the proper planning of the interior installations, the water requirements of the various plants may be calculated from the volume of the crops to be attained on the basis of the moisture requirements per unit of crop. On this basis, the water requirements of clover and fodder beet within the crop rotation are as follows:

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In the case of clover, on the basis of 60 quintals of uncut crop per cadastral yoke, the fodder product will amount to 84 percent or 5,040 kilograms per cadastral yoke. Clover requires the evaporation of 700 liters of water per kilogram, equivalent to 3,528,000 liters per cadastral yoke, which, in turn, equals a water coverage of 614 millimeters.

If precipitation, on the basis of the averages for many years, is computed at 278 millimeters (that is, 1,600,000 liters per cadastral yoke) in the growing season and the soil moisture derived from the fall and winter rainfalls is computed at 160 millimeters (that is, 921,000 liters per cadastral yoke) and, finally, if the combined effectiveness of precipitation and irrigation is computed at 66 percent, then it is evident that the net water requirement to be covered by irrigation is 267 millimeters. Taking account of losses due to evaporation and drainage, a water coverage of 400 millimeters, equivalent to 2,300,000 liters of gross irrigation water, will therefore be needed.

In the case of fodder beet, the standing crop averages 650 quintals per cadastral yoke, with a 10-percent yield equaling 6,500 kilograms. Since 500 liters of water are required to produce one kilogram of fodder beet, the total net water requirement per cadastral yoke will amount to 3,25.,000 liters, equal to 564 millimeters. Soil moisture and precipitation supply 345 millimeters (1,987,000 liters per cadastral yoke); therefore, the net irrigation water requirement is 219 millimeters. Assuming a 66-percent effectiveness, gross irrigation water requirement per cadastral yoke will total 1,843,000 liters, equivalent to 320 millimeters.

The net and gross water requirements of the plants within the crop rotation can be calculated on the above basis. The planner is thereby able to estimate the expenditure for the irrigation project.

For reasons of economy, it is essential to set up a daily operating schedule for the irrigation projects. This schedule is closely connected with the capacity of the canals and of technical installations because canals of a smaller profile will be adequate if the daily operating time is longer. Smaller canals occupy less area and leave more space for production; their mechanical equipment is less expensive, and the utilization of the machines is more economical. For the first irrigation of rice, a 22-hour schedule, and for the second irrigation, a 20-hour schedule are best suited. In case of cultivated and clover crops, where the irrigation process requires greater care, a 16- to 18-hour shift is practical.

The irrigation method of a 200 cadastral-yoke field used in part for rice growing under crop rotation is as follows:

Crop	Percent	Cadastral Yokes
Rice	30	60
Clover	50	100
Cereals	10	20
Cultivated crops	10	20
Total	100	200

The irrigation water requirements of the above-mentioned crops can be met by the following method:

On the basis of a 22-hour daily schedule and a 400-millimeter water coverage, rice requires for the first irrigation (for the 15 days between 20 April and 5 May) a volume of 2,304 cubic meters of water. This volume, in turn, requires approximately 2 liters per second per cadastral yoke, totaling 120 liters per second for 60 cadastral yokes.

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After the first irrigation of the rice field, the volume of water required from 6 May to 31 August (118 days) is 6,336 cubic meters per cadastral yoke, equivalent to a water coverage of 1,100 millimeters. On the basis of a 20-hour schedule per day, this volume requires 0.75 liters per second, or 45 liters per second for 60 cadastral yokes.

It is evident, therefore, that the water requirements of rice during the whole growing season can be satisfied with 8,640 cubic meters or, in round figures, 9,000 cubic meters of irrigation water, equivalent to a water coverage of 1,500 millimeters.

Clover requires five irrigations during its growing period. Each irrigation is performed 6 to 7 days after mowing and requires an average of 460 cubic meters of water per cadastral yoke, equal to a water coverage of 80 millimeters. These five irrigations are performed between the following dates: 15 May-23 May, 10 June-18 June, 5 July-13 July, 1 August-8 August, and 25 August-3 September. Each irrigation requires 8 days, with an 18-hour daily schedule. For the water requirements of clover, 0.88 liters per minute, or, in round figures, 0.9 liters per minute are necessary, that is, 90 liters per second for 100 cadastral yokes.

Cultivated crops (such as beet, corn, sunflower, etc.) require four irrigations. For each watering an average of 460 cubic meters of water is used, equivalent to a coverage of 80 millimeters, from 18 June to 23 June, from 13 July to 18 July, from 8 August to 13 August, and, if necessary, from 3 September to 13 September. Each irrigation period has 5 days with a 16-hour daily schedule. The necessary volume of water is 1.6 liters per second, that is, 32 liters per second for 20 cadastral yokes.

The water requirements of the fall cereals are, as a whole, negligible because in case of normal weather irrigation is unnecessary. The artificial watering of spring cereals is, however, justified. The cereal crop requires two irrigations: between 15 April and 20 April and between 1 June and 5 June. Each irrigation requires 403 cubic meters of water per cadastral yoke, equivalent to a coverage of 70 millimeters, performed in daily shifts of 16 hours. The necessary amount of water is 1.4 liters per second per cadastral yoke, that is, 28 liters per second for 20 cadastral yokes.

The water requirements of a secondary crop, following the cereal crop, between 1 July and 5 July, amount to 576 cubic meters of water per cadastral yoke, equivalent to a water coverage of 100 millimeters during the preliminary irrigation which is performed in 20-hour daily shifts. The water requirement is 1.60 liters per second per cadastral yoke, or 32 liters per second for 20 cadastral yokes. During the growing season, irrigation is performed between 25 July and 31 July, when 460 cubic meters (80 millimeters) of water per cadastral yoke are required in 18-hour daily shifts. Thus, the water requirements are 1.20 liters per second per cadastral yoke or a total of 24 liters per second.

On the above basis, maximum water requirements are 120 liters per second. As a result, the volume of the permanent water stream is 0.6 liters per second per cadastral yoke. Therefore, the canals and mechanical installations must have a capacity of 120 liters per second.

During the growing season, between 20 April and 1 September, the utilization of the irrigation projects reaches an average of 80 percent. Maximum volume of irrigation is attained during the first watering of rice, with 450 liters per second. The volume of the permanent water stream is 0.45 liters per second. During the growing season, 91-percent exploitation of the interior machinery is feasible, which, for practical purposes, may be regarded as the maximum.

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The following table shows the irrigation system for an area of 200 cadastral yokes on which fodder (without rice) is grown in rotation:

Crop	Percent	Cadastral Yokes
Clover	60	120
Cultivated crops	20	40
Cereals	20	40
Total	100	200

The watering of clover requires the maximum volume of irrigation, or 85 liters per second; the capacity of the canals, therefore, should conform to this water requirement. The volume of the permanent stream is 0.42 liters per second per cadastral yoke, and since the installation is only 48 percent utilized, the system described above is uneconomical.

This year, approximately 100,000 cadastral yokes are under irrigation, resulting in a net increase of 100 million forints in the national income. By the end of the Five-Year Plan, the extent of the irrigated lands will be 3.5 times greater than today, which will mean an annual increase of 400 million forints in the national income.

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